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(54) Composite facestocks.

(57) Disclosed is a multilayer facestock comprising a coextrudate of cojoined layers, characterized by a coextrudate of a relatively thick core layer (52) of polymeric film material, which contributes the majority of the stock's dimensional stability and stiffness, the degree of the stiffness being suitable for the label or sign application, and at least one relatively thin skin layer (54,56) of polymeric film material at least on the face side of the coextrudate and having an ink-printable surface, and a pressure-sensitive adhesive layer (58) combined at the side of said coextrudate opposite said face side.

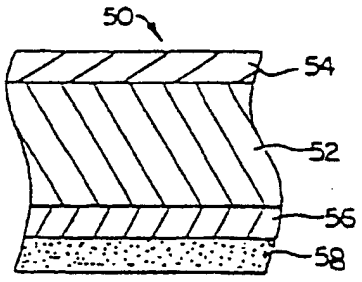

FIG. 1

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The present invention relates to web stock for display products such as labels, signs and the like, and more particularly to constructions and methods of making film facestocks for such display products.

It has long been known to manufacture and distribute pressure-sensitive adhesive stock for display products such as labels and signs by providing a layer of face material for the label or sign backed by a layer of pressure-sensitive adhesive which in turn is covered by a release liner. The liner protects the adhesive during shipment and storage. With specific reference to labels, the liner also allows for efficient handling and dispensing of individual labels which have been die-cut from the layer of face material while leaving the liner uncut.

Many label and sign applications require that the face material be a polymeric film material which can provide properties lacking in paper, such as weatherability (for outdoor signs), strength, water resistance, abrasion resistance, gloss and other properties. Because material costs in the manufacture of such film facestocks are relatively high, the desirability of reducing material costs without sacrifice of quality has long been apparent, but little or nothing has been accomplished toward this end.

The present invention opens the way to substantial cost savings in the manufacture of film facestocks while at the same time maintaining the desirable characteristics of the film facestocks which have been used prior to this invention. In a word, costs are greatly reduced at little or no sacrifice of quality, and even with a gain in quality in some instances.

The present invention provides a multilayer facestock comprising a coextrudate of cojoined layers, characterized by a coextrudate of a relatively thick core layer of polymeric film material which contributes the majority of the stock's dimensional stability and stiffness, the degree of stiffness being suitable for the label or sign application, and a relatively thin skin layer of polymeric film material at least on the face side of the coextrudate and having an ink-printable surface, and a pressure-sensitive adhesive layer combined at the side of said coextrudate opposite said face side.

The present invention further provides a method for manufacturing multilayer facestock comprising the steps of:

providing a first charge of a film-forming resin;

providing a second charge of a film-forming resin;

coextruding said first and second charges to form a multilayer extrudate comprising a relatively thick core layer and a relatively thin skin layer on one side of the coextrudate;

and combining said extrudate with a pressure-sensitive adhesive layer to form a facestock,

said first charge for the core layer being preselected as by selection of density or flex modulus, to provide the degree of stiffness suitable for the label or sign application , and

said resin of said second charge being selected to provide an ink-printable surface.

The facestock of the present invention may be combined on its adhesive side with a releasable liner, which advantageously may be of a multilayer web construction of the type which forms the subject of the

EP Application No. 86901268.2 (Publication No. 0210261).

The invention will now be described in more detail with reference to the accompanying drawings, in which:

FIG. 1 is a schematic, cross-sectional view of one embodiment of multilayer facestock in accordance with the invention;

FIG. 2 is a schematic, cross-sectional view of another embodiment of multilayer facestock in accordance with the invention;

FIG. 3 is a schematic cross-sectional view of yet another embodiment of multilayer facestock in accordance with the invention; and

FIG. 4 is a diagrammatic illustration of a method in accordance with the invention of manufacturing the facestock of FIG. 1.

Typical examples of film facestocks illustrating the invention are shown in FIGS. 1 and 2. In FIG. 1, a multilayer web construction, generally indicated by the reference numeral 50, comprises a coextrudate including a core layer 52, a skin layer 54 on the face side of the coextrudate, and a skin layer 56 on the inner side of the coextrudate opposite the face side. Combined on the inner side of the coextrudate is a pressure-sensitive adhesive layer 58. In FIG. 2, a multilayer web construction, generally indicated by the numeral 50a, comprises layers 52a, 54a, 56a, and 58a generally corresponding to the layers 52, 54, 56 and 58 in FIG. 5. However, in FIG. 2, tie layers 53 join the core layer 52a to the skin layers 54a and 56a.

The coextrudates of FIGS. 1 and 2 comprise polymeric film materials, which are formed by simultaneous extrusion from a suitable known type of coextrusion die, and which are adhered to each other in a permanently combined state to provide a unitary coextrudate. The FIG. 1 construction is used when the materials of the core and skins are such that these layers firmly adhere or bond to each other when coextruded as adjacent film layers. The FIG. 2 construction, with the tie layers 53, is used when the core and skin materials do not sufficiently adhere or bond to each other when they are extruded together. Generally, the construction of FIG. 1 is presently used for roll film facestock and that of FIG. 2 for sheet film facestocks be-

cause, while polyethylene is presently preferred as the core material for both applications, roll film facestocks and sheet film facestocks generally use different skin materials, and the presently preferred material for the skin of the roll film facestock (ethylene vinyl acetate) is compatible with polyethylene in respect of inherent adhesion or bonding, while the presently preferred material for the skin of the sheet film facestock (polyvinyl chloride) is not. The term "roll film facestock" refers to facestock which is provided in roll form and typically is provided for the manufacture of labels. The term "sheet film facestock" refers to facestock which is provided cut into sheet form to be decorated (by screen printing, for example) for use as decals, bumper stickers, thermal die-cut signs, and the like.

The materials of the layers of constructions 50 and 50a are selected according to the cost/benefit characteristics of candidate materials considering the functional or operational requirements of the layer in question.

Thus, the facestock at its outside surface may require high weatherability and printability and good uniformity and control of surface texture, whether gloss or matte, whereas these qualities either are not necessary or are required in far lesser degree in the core of the facestocks. The latter, however must be such as to give the facestock opacity and the desired degree of stiffness, as well as sufficient body and strength, and represents generally the great bulk of the total material used in the construction.
The inner surface of the film coextrudate must give good anchorage for the adhesive.

The presently preferred material for the core layers 54 or 54a in many facestock applications is polyethylene of low, medium or high density of between about 0.915 and 0.965 specific gravity. This is a relatively low cost, extrudable film-forming material whose stiffness (ranging through decreasing degrees of flexibility to semirigid) may be determined by the density selected, and whose body and strength are sufficient for most uses. Polyethylene of lower densities, down to a specific gravity of 0.890, may be employed for greater flexibility.

Another preferred material for the core layers 54 or 54a is polypropylene (or a propylene copolymer) having a flex modulus range of between about 8.96×10^8 - 17.2×10^8 Pa at 22.8 °C (about 130,000 and 250,000 psi at 73 °F), depending on the stiffness desired.

Ethylene vinyl acetate is generally the presently preferred material for both skin layers 54 and 56 in roll film applications, while polyvinyl chloride is generally the presently preferred material for both skin layers 54a and 56a in sheet film applications. A suitable resin for tie layer 53 in this instance is "CXA", marketed by DuPont. Another material for forming tie layers is "Plexar" marketed by Chemplex Co. Other specific materials are also available for performing the tying function in coextrusion operations. The outer surface of the skin layer 54 or 54a is corona-treated in a known manner to increase printability of the skin.

The preferred identity of the outer and inner skin layer material at present is partly a choice of convenience in practice, and it is contemplated that these materials often will not be identical in actual manufacture. For example, ethylene vinyl acetate might be the material of choice for the outer skin, but ethylene acrylic acid might be used on the inner skin for better anchorage to, say, an acrylic adhesive of choice.

Other materials for the skin layers include ethylene acrylic acid, ethylene methyl acrylic acid, ethylene ethyl acrylate, ethylene methyl acrylate, acrylonitrile butadiene styrene, nylon, polybutylene, polystyrene, polyurethane, polysulfone, polyvinylidene chloride, polypropylene, polycarbonate, polymethyl pentene, styrene maleic anhydride, styrene acrylonitrile, ionomers based on sodium or zinc salts of ethylene/methacrylic acid, acrylics, cellulosics, fluoroplastics, nitriles and thermoplastic polyesters.

While the foregoing examples of facestocks have employed skin layers on each side of the core, there are instances where a skin layer is employed only on the outer side of the construction, such as the construction 60 shown in FIG. 3, which employs the single skin layer 66 on the outer side of a core layer 62. In this instance, the pressure-sensitive adhesive layer 68 is directly adjacent the core layer. For example, such a construction could be used for the manufacture of high durability labels. Material presently preferred for the core layer in such instance is polyvinyl chloride or acrylonitrile butadiene styrene, and for the skin layer, polyvinylidene fluoride.

It will be understood from the foregoing that multilayer film facestocks have been provided having a relatively thick core layer of polymeric film material which contributes the majority of the stock's dimensional stability and stiffness, having a cojoined, relatively thin, ink-printable skin layer at least at the face side of the construction, and having a pressure-sensitive adhesive layer combined at the sides of the construction opposite the face side. From a method standpoint, this is accomplished by coextruding a plurality of at least two charges of film-forming resin to form a coextrudate having a relatively thick core layer and at least one relatively thin skin layer after preselecting the charge for the core layer, as by selection of density or flex modulus, to provide the degree of stiffness suitable for the label or sign application, and after preselecting the charge for the skin layer

to provide a skin adapted to the intended decorating process, and combining the coextrudate with a pressure-sensitive adhesive layer.

Thus, in the manufacture of the facestock 50 seen in FIG. 1, charges D, E and F, corresponding respectively to layers 52, 54 and 56, may be prepared for coextrusion through a coextrusion die 70, as schematically illustrated in FIG. 4. Charge D for the core layer 52 is preselected to provide the suitable degree of stiffness, charge E is preselected to allow for good printability (usually following corona treatment of the formed film) and for weatherability if indicated, and charge F is preselected for good adhesive anchorage. As previously indicated, often charges E and F for the skin layers may be the same, and in some applications, the skin layer on the inner or adhesive side, corresponding to charge F, is eliminated. The coextrudates 54, 52, 56 forming the facestock may be hot-stretched.

The coextrudate may be directly coated with the adhesive 58, or the adhesive 58 may be transferred from a liner with which the facestock is combined. In particular, the coextrudate of cojoined facestock layers 54, 52, 56 may be substituted for the facestock 32 of

FIGS. 3B to 3D of the EP Application No. 86901268.2 (Publication No. 0210261), and the adhesive 58 may be the adhesive applied at the coating station S in said FIG. 3A. The result is an all-plastic facestock/liner combination in which both the facestock and liner are multilayered.

Instead of being coated or combined on the formed coextrudate as just described, the adhesive 58 may be coextruded along with the film-forming layers 54, 52, 56. The invention also contemplates simultaneously extruding both liner and facestock as by simultaneously extruding all the charges A through F, together with a charge of adhesive 58, which would for example be extruded through an additional orifice adjacent to the orifice for charge F. This would require provision of release means for the liner prior to contact of the liner by the adhesive.

The facestock construction 50a is manufactured in a manner similar to the manufacture of facestock 50. The additional tie layers 53 are coextruded along with the layers 52a, 54a and 56a.

Claims

1. A multilayer facestock comprising a coextrudate of cojoined layers, characterized by a coextrudate of a relatively thick core layer (52, 52a, 62) of polymeric film material, which contributes the majority of the stock's dimensional stability and stiffness, the degree of the stiffness being suitable for the label or sign application, and a relatively thin skin layer (54, 54a, 66) of polymeric film material at least on the face side of the coextrudate and having an ink-printable surface, and a pressure-sensitive adhesive layer (58, 58a, 68) combined at the side of said coextrudate opposite said face side.

2. The facestock according to claim 1, wherein said coextrudate comprises a second relatively thin skin layer (56, 56a) of polymeric film material between the core layer (52, 52a) and the adhesive layer (58, 58a).

3. The facestock according to one of the preceding claims, wherein the polymeric material of said core layer (52, 52a) is polyethlene, especially a polyethylene of a specific gravity of from 0.890 to 0.965 or a polypropylene polymer or copolymer with a flex modulus range of from 8.96×10^8 - 17.2×10^8 Pa at 22.8 °C (130,000 to 250,000 psi at 73 °F).

4. The facestock according to any preceding claim, wherein said core layer (52, 52a) renders said facestock opaque.

5. The facestock according to any preceding claim, wherein the or each skin layer (54, 56; 54a, 56a) comprises ethylene-vinyl acetate, ethylene acrylic acid, ethylene methyl acrylic acid, ethylene ethyl acrylate, ethylene methyl acrylate, acrylonitrile butadiene styrene, nylon, polybutylene, polystyrene, polyurethane, polysulfone, polyvinyl chloride, polyvinylidene chloride, polypropylene, polycarbonate, polymethyl pentene, styrene maleic anhydride and styrene acrylonitrile.

6. The facestock according to claim 5, wherein the or each said skin layer (54, 56; 54a, 56a) comprises ethylene-vinyl acetate or polyvinyl chloride having a corona-treated outer surface.

7. The facestock according to any preceding claim, wherein the coextrudate comprises a single skin layer (66)

8. The facestock according to claim 7, wherein said skin layer (66) is polyvinylidene fluoride and said core layer (62) is polyvinylchloride or acrylonitrile-butadiene-styrene.

9. The facestock according to any preceding claim, wherein said coextrudate includes a tie layer (53) between said core layer (52a) and the or said skin layer (54a, 56a).

10. The facestock according to any preceding claim, wherein said adhesive layer (58, 58a, 68) is combined by being coated thereon, transferred from a liner with which the facestock is combined, or by being coextruded therewith.

11. The facestock according to any preceding claim, wherein said facestock is hot-stretched.

12. The facestock according to any preceding claim, combined with on its adhesive side with a releasable liner.

13. A label cut from a multilayer facestock as defined in any preceding claim.

14. A method for manufacturing multilayer facestock comprising the steps of:
providing a first charge of a film-forming resin;
providing a second charge of a film-forming resin;
coextruding said first and second charges to form a multilayer coextrudate comprising a relatively thick core layer (52,52a,56a) and at least one relatively thin skin layer (54,54a,66) on one side of the coextrudate;
and combining said coextrudate with a pressure-sensitive adhesive layer (58,58a,68) to form a facestock (50,50a,60), said first charge for the core layer being preselected as by selection of density or flex modulus, to provide the degree of stiffness suitable for the label or sign application, and said resin of said second charge being selected to provide an ink-printable surface.

15. The method according to claim 14, comprising the additional steps of:
providing a third charge of a film-forming resin, and
coextruding said third charge with said first and second charges whereby the extrudate comprises a second relatively thin skin layer (56, 56a) on the opposite side of the core layer (52, 52a).

16. The method according to claim 14 or 15, wherein said first charge is polyethylene, especially polyethylene of a specific gravity of from 0.890 to 0.965 or a polypropylene polymer or copolymer with a flex modulus range of from 8.96×10^8 - 17.2×10^8 Pa at 22.8 °C (130,000 to 250,000 psi at 73 °F).

17. The method according to any preceding claim, wherein said core layer (52, 52a) renders said facestock opaque.

18. The method according to claims 14 to 17, wherein the second charge and/or third charge if used comprises ethylene-vinyl acetate, ethylene acrylic acid, ethylene methyl acrylic acid, ethylene ethyl acrylate, ethylene methyl acrylate, acrylonitrile butadiene styrene, nylon, polybutylene, polystyrene, polyurethane, polysulfone, polyvinyl chloride polyvinylidene chloride, polypropylene, polycarbonate, polymethyl pentene, styrene maleic anhydride and styrene acrylonitrile.

19. The method according to claim 18, wherein the second charge and/or third charge if used comprises ethylene-vinyl acetate or polyvinyl chloride having a corona-treated outer surface.

20. The method according to claim 14, wherein the first charge is polyvinyl chloride or acrylonitrile-butadiene-styrene and the second charge is polyvinylidene fluoride.

21. The method according to any one of claims 14 to 20, wherein said pressure-sensitive adhesive layer is combined with said extrudate by transfer coating or by direct application following said step of coextruding.

22. The method according to any one of claims 14 to 20, wherein said pressure-sensitive adhesive layer is combined with said extrudate by coextruding said adhesive layer simultaneously with the other layers.

23. The method according to any one of claims 14 to 22, including the additional step of coextruding a tie layer (53) between said core layer and the or each said skin layers.

24. The method according to any one of claims 14 to 23, comprising the additional step of corona-treating the outer surface of the skin layer, or of the skin layer opposite said adhesive layer if there are two said skin layer, to increase the printability of said surface.

25. The method according to any one of claims 14 to 24, comprising the additional step of combining the face stock with a liner.

26. The method according to any one of claims 14 to 25 comprising the additional step of hot-stretching said coextrudate.

27. A method of manufacturing an all-plastic stock suitable for use by manufacturers of adhesive and printable products, comprising the steps of:

coextruding a liner comprising a plurality of layers of film-forming resin;
either simultaneously with said extrusion step or subsequently thereto combining release means (26) at one face of said liner coextrudate;
either simultaneously with or subsequently to said extrusion step also coextruding facestock (50) comprising a plurality of layers of film-forming resin by a method according to any one of claims 14 to 25; and
either simultaneously with or subsequently to said first-mentioned coextrusion step temporarily joining said liner and said facestock (50) by contacting the pressure-sensitive adhesive layer (58) of said facestock (50) with said release means (26) combined with said liner.

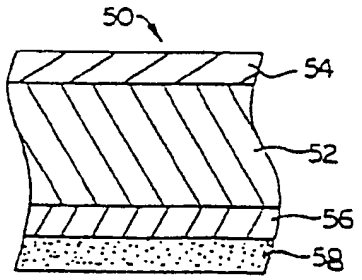

FIG. 1

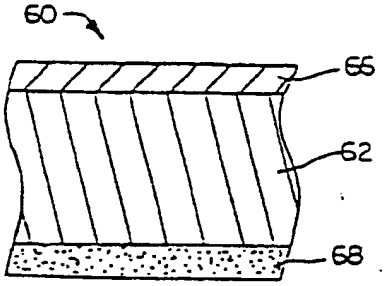

FIG. 3

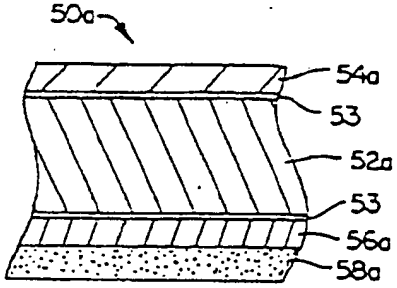

FIG. 2

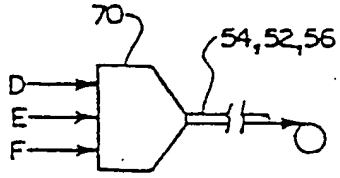

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 95 10 9857

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.4)
X	DE-A-24 02 120 (MINNESOTA MINING & MFG) 1 August 1974 * claims 1,3,4,7,9 *	1,10,11, 14	B32B27/08 G09F3/02
A	GB-A-1 404 018 (OJI YUKA GOSEISHI KK) 28 August 1975 * page 1, line 11 - line 17 * * page 2, line 89 - page 3, line 21 * * page 3, line 107 - line 121 * * page 4, line 4 - line 32 *	1,4-6, 10,11	
A	EP-A-0 060 421 (KUREHA CHEMICAL IND CO LTD) 22 September 1982 * page 5, line 19 - page 6, line 2 * * page 11, line 10 - line 19 * * page 15, line 5 - line 6 *	1,7-9	
A	GB-A-1 465 973 (MINNESOTA MINING & MFG) 2 March 1977 * page 2, line 105 - page 3, line 14 * * page 3, line 111 - line 130 *	1,14	
			TECHNICAL FIELDS SEARCHED (Int.Cl.4)
E	US-A-4 582 736 (DUNCAN GARY L) 15 April 1986 * claims 1,6,10,12 * * column 6, line 37 - line 44; example 1 *	1,4,5,14	B32B G09F
A	US-A-4 377 616 (ASHCRAFT CHARLES R ET AL) 22 March 1983 * column 2, line 43 - line 55 * * column 6, line 25 - line 30; example 1 *	1-5	
A	GB-A-1 384 556 (MITSUBISHI PETROCHEMICAL CO) 19 February 1975		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	3 August 1995	McConnell, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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